Capital Structure and Arbitrage

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ABSTRACT

Capital structure is crucial to the income of corporations. And different arbitrage strategies can be set based on the different capital structures. However, the existing description of how capital structure can affect the financial state and how a company can take advantage of arbitrage is relatively obscure. Based on the Modigliani-Miller Proposition (MM Proposition), we analyze the firm value of two hypothetical companies and the possible risk facing them. Then we use the Weighted Average Cost of Capital (WACC) to compare whether they are in equilibrium. We find that with the same firm value (real asset), the firms are in equilibrium. Meanwhile, the investor can draw the advantage of arbitrage by selling an existing asset or borrowing from the public market, or both to purchase a new firm's equity. This paper provides a better method to compare the financial state of different firms and use arbitrage strategy.

Keywords: Capital structure, Arbitrage, MM proposition, Firm value, WACC, Risk.

1. INTRODUCTION

Numerous factors can affect the financial state of a company. For instance, external factors like cost price, economic crisis, currency inflation, and taxation. While there are also some internal factors such as the operation pattern, the cash flow. This paper will focus on the effect of capital structure on the company's profit or loss. Capital structure, the particular combination of companies' equity and debt, is used to manage its overall operations and growth and significantly influence corporate income.

The previous research of capital structure aims to explain the mix of financing sources and securities used by firms to finance real investment. And most of the study on the capital structure has paid so much attention to the proportions of debt vs. equity [1]. The maximization of the enterprise's value is its fundamental financial purpose. Operating cycle management could contribute to managing this basic aim [2]. To exam the firm value, we are supposed to use the Modigliani-Miller Proposition (MM Proposition). And its real contributions are the central assumptions of perfect capital markets and the associated arbitrage argument [3]. The weighted average cost of capital can make a difference in the corporate investment, and the form of influence is determined by the measurement of the cost of equity [4]. Moreover, an understanding of the risk facing by corporations is of great significance

because of the increasingly global nature of investment portfolios [5].

At the same time, arbitrage also has drawn great attention recently. It can be defined as an investment strategy that ensures a positive payoff in some contingency with no possibility of a negative payoff and no net investment [6]. And by choosing the proper arbitrage strategy, the company can make a profit without any cost.

Therefore, this paper is aimed to find out if two firms have the same borrowing cost and equity cost of capital but different firm values are in equilibrium. And if not, is there an arbitrage strategy that can make a profit based on this difference. To achieve this, we first compare the firm value. Then we use the Weighted Average Cost of Capital (WACC) to compare their total return ratio. After that, we find out the possible risks facing by these firms. The result shows that with the same borrowing cost and equity, the firm value determines two companies are in equilibrium or not. If the firm values are equal to each other, the two firms are also in equilibrium. If not, the company with higher firm value is relatively overpriced. And the firms' funds by both debt and equity are facing financial risk. In addition, by selling an existing asset or borrowing from the public market, or both to purchase a new firm's equity, investors can make an arbitrage.

The structure of this paper is first introducing the firm value, which can be figured out using the firm's

debt and equity. After that, it exams the WACC and the various risks facing by the companies. Then it gives an arbitrage strategy based on the given situation.

2. BACKGROUND

This article is mainly based on the capital structure of two corporates to explore the influence of capital structure on corporate income. The following data is from these two companies, A and B. Both companies are supposed to be in an ideal and perfect market, where the taxes and transaction commission are absent. We also assume A and B are both exchange-listed companies with equally risky investment projects, and their financial information is given as follows:

Table 1. Firms' information

Company	A	B
Expected perpetual operating income p.a.	300,000	300,000
Market value on debt	0	750,000
Borrowing costs	10%	10%
Equity cost of capital	15%	15%
The market value of equity	2,000,000	1,500,000

An investor is holding 10% of B's equity, and he or she can borrow privately at a rate of 10% p.a.

We denote that

E(A), E(B) for the equity asset of firm A and B

D(A), D(B) for the debt asset of firm A and B

V(A), V(B) for the firm value of A and B, where V=E+D

$R_d(A)$, $R_d(B)$ for the debt cost of firm A and B

$R_e(A)$, $R_e(B)$ for the equity cost of firm A and B

i for the interest rate of the public market.

3. THE EQUILIBRIUM OF COMPANY A AND B

This article will figure out whether the two firms are in equilibrium or not to find the relationship between the firm structure and firm price.

3.1. Firm Value

MM Proposition

The MM theory supposes that under a well-functioning market, where is no taxes, transaction costs, or asymmetric information and in a perfect market, the cost of capital and the value of the firm are not affected by the changes in capital structure, the firm's value depends only on the income stream generated by its real assets, not by the securities it issues [7]. In other words,

when considering the equilibrium situation, it is not the firm structure but the firm value (real asset) that counts. Therefore, to reach the equilibrium, firm A and B are supposed to have the same firm value, which can be denoted by V. The equation can be given as follow:

$$V = D + E \qquad (1)$$

Using equation (1), we have

$$V(A) = D(A) + E(A)$$
$$= 2,000,000$$
$$V(B) = D(B) + E(B)$$
$$= 2,250,000$$

where V(A) and V(B) represent the firm value of A and B

we can tell V(A) < V(B), hence company A is relatively underpriced to company B.

The MM proposition also suggests that the expected rate of return for shareholders increases along with the firm's leverage ratio increasing. Thus when in equilibrium, hence the two firms must have the same WACC.

3.2. Weighted Average Cost of Capital

WACC

WACC, a calculation of a company's cost of capital, aims to include all capital sources, in which each category of capital is proportionately weighted. A weighted average is not equal to the cost of capital, which is defined as the discount rate that equates future payments made to all capital sources with their combined market value [8]. The WACC calculation formula is given as follows:

$$WACC = \frac{E}{V} \times R_e + \frac{D}{V} \times R_d (1-T_c)$$

where Tc is the corporate tax rate. Tc is supposed to be 0, since we have stated these two companies are in the frictionless market.

Hence the formula can be simplified to

$$WACC = \frac{E}{V} \times R_e + \frac{D}{V} \times R_d \qquad (2)$$

Empirical Test

The WACC of firm A and WACC of the firm of B, which are denoted by WACCa and WACCb, by simply substituting the values into equation (2), because we have all the elements in the equation:

$$WACC_a = \frac{E(A)}{V(A)} \times R_e(A) + \frac{D(A)}{V(A)} \times R_d (A)$$
$$= 15\%$$

and

$$WACC_b = \frac{E(B)}{V(B)} \times R_e(B) + \frac{D(B)}{V(B)} \times R_d(B)$$

With equation (1), we get

$WACC_b = 13.33\%$

Hence we can see that $WACC_a > WACC_b$ which means firm A's WACC, the average return, is higher than firm B. Firm A and B are not in equilibrium in the aspect of return.

3.3. The Risks Facing by Firm A and B

As a result of the instability of real-world market and the imperfection of corporate operation, the companies in the real world are facing various risk, including

The market risk, the possibility of an individual or other entity to experience losses because of factors that affect the overall performance and profitability of investments in the financial markets.

The systematic risk, is known as "undiversifiable. risk, which is inherent to the entire market or market segment. It can influence the overall market, not just a particular stock or industry.

Political risk may deprive a company of its assets, restrict its capacity to fulfill a contract, and prevent it from paying loan repayments. Potential scenarios have a very broad range, but all of them are likely to have a critical effect on the balance sheet.

Interest rate risk, the possibility for investment losses that arise from an interest rate change. For example, if interest rates rise, the value of a bond or other fixed-income investment will decrease.

Operational risk, when a firm is attempting to do its daily business activities within a given industry or field, it might encounter uncertainties and hazards, which is called operational risk.

Financial risk, the possibility of losing money on an investment or business venture. Some more common and distinct financial risks include credit risk, liquidity risk, and operational risk.

Under our assumption, the companies are also facing the risks above. Therefore, we are trying to explore the influence of financial risk on corporate income.

One firm's Weighted Average Cost of Capital increases as the rate of return on equity increase resulting from the increase in WACC denotes a deduction in the valuation and an increase in risk.

Because firm A is only fund by equity, while firm B consists of both equity and debt, which means it will suffer from the financial risk, which is supposed to lead to a higher price.

To accommodate the aromatic changes of the global economy, the risk management field is supposed to evolve substantially [9]. Therefore, set arbitrage strategy might be a possible way out.

4. ARBITRAGE

Arbitrage can be defined as the strategy of taking advantage of price differences of the same asset in different markets to make a profit. For it to take place, there must be a situation where at least two equivalent assets with different prices. Essentially, arbitrage is when an investor can profit from the imbalance of asset prices in different markets. The simplest way of arbitrage is to purchase an asset in the lower price market and simultaneously sell the higher one. The most significant advantage of arbitrage is all the investors can improve their current portfolios by reassociating their assets [10].

Empirical Test

To make an arbitrage profit, the investor could take steps as follows:

1. Sell 10% of B's equity and take the cash $10\% \times 1,500,000 = 150,000$

2. Borrow from the public market, the amount can be equal to 10% of B's debt

$10\% \times 750,000 = 75,000$

3. Use the proceeds of $150,000 + 75,000 = 225.000$ in total to purchase firm A's equity.

In these steps, the leverage of firm B is replicated privately so that both the prior position in B and the new leveraged position in A have the same financial risk and hence perfect hedge each other.

When the investor-owned 10% of firm B's equity, he or she can make

$E(B) \times 10\% \times R_e(B) = 1,500,000 \times 10\% \times 15\% = 22,500$

Make Table 2 by taking the arbitrage strategy.

Table 2. Arbitrage Strategy

	Year 0	Year 1
Sell 10% B's equity	150,000	
Borrow from the public market.	75,000	
Purchase A's equity.	-225,000	
Earn by owning A's equity.		33750
Pay tax		-7,500
Total	0	26,250

From Table 2, it can be observed visually. The investor could make profit P at the end of this year

P = 225,000 $\times$ R$_e$(A)

   = 33,750

but should also pay tax T at the same time point

T = 75,000 $\times$ i

   = 7,500

hence the investor's profit and loss, P&L, is

P&L = P - T

    = 26,250

which is 26,250 – 22,500 = 3,750 high than prior strategy. In other words, the investor could make a 3,750 profit by the arbitrage strategy.

The concept is closely related to the market efficiency theory. The theory states that for markets to be perfectly efficient, there must be no arbitrage opportunities – all equivalent assets should converge to the same price. The convergence of the prices in different markets measures market efficiency.

5. CONCLUSION

This paper first takes the example of two corporations to exam the effect of capital structure on the company's financial income. Then we introduce the MM proposition and compare the firm values. After that, we use the WACC to figure out the return of each firm. We also analyze the risks facing by different companies. In addition, we set a possible arbitrage strategy based on the given situation to reduce risk.

The result can be drawn from this paper. First, to reach equilibrium, two firms must have the same firm value and WACC. Otherwise, the firm with higher firm value is relatively overpriced. Meanwhile, the risks can contribute to the disequilibrium. The company making use of debt is facing financial risk, which has no impact on the ones only fund by equity. Moreover, the investor could take advantage of arbitrage by selling an existing asset or borrowing from the public market or purchasing new equity.

However, this study has some limitations. For example, we assume the market is perfect, and the investors do not need to pay commission when longing or shorting their assets. Meanwhile, this paper does not consider corporate taxes. However, in the real world, these assumptions are unrealistic. Moreover, this paper ignores the limitations and drawbacks of arbitrage, which do exist in the real market. In the future study, we will add all these variables and examine the specific advantages and disadvantages of arbitrage.

REFERENCES

[1] Myers, S. C. Capital structure. Journal of Economic perspectives, 2001, 15(2), 81-102.

[2] Michalski, G. Factoring and the firm. value. FACTA UNIVERSITATIS Series: Economics and Organization, 2008, 5(1), 31-38.

[3] Abad, P. Perfect Market, Arbitrage, and Value Creation in the MM Proposition. Arbitrage, and Value Creation in the MM Proposition, March 14, 2020.

[4] Frank, M. Z., & Shen, T. Investment and the weighted average cost of capital. Journal of Financial Economics, 2016, 119(2), 300-315.

[5] Erb, C. B., Harvey, C. R., & Viskanta, T. E. Political risk, economic risk, and financial risk. Financial Analysts Journal, 1996, 52(6), 29-46.

[6] Dybvig, P. H., & Ross, S. A. Arbitrage. In Finance, 1989, pp. 57-71. Palgrave Macmillan, London.

[7] Villamil, A. P. The Modigliani-Miller Theorem. The New Palgrave Dictionary of Economics, Second Edition. Eds. Steven N. Durlauf and Lawrence E. Blume. Palgrave Macmillan, 6. 2008.

[8] Ang, J. S. Weighted average vs. true cost of capital. Financial Management, 1973, 56-60.

[9] Jorion, P. Value at risk: the new benchmark for managing financial risk. 2002.

[10] Huberman, G. A simple approach to arbitrage pricing theory. In Theory of Valuation, 2005, pp. 289-308.